~~Freewheel bearing device and freewheel pulley~~

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to ~~the field of~~ freewheel bearings, in particular sprung freewheel bearings.

2. Description of the Relevant Art

~~Such~~ Freewheel bearing devices include ~~comprise~~ two elements that can rotate concentrically relative to one another in freewheel mode, ~~and between which there is the need to be able to~~ The two elements transmit a torque without relative movement between the two elements when the device operates in torque take-up mode.

In sprung freewheel devices, a helical spring usually performs the freewheel function. The helical spring is fixed~~ly attached~~ by one of its ends to one of the two elements of the device. ~~and, in~~In one relative direction of rotation between the two elements, the helical spring rubs without binding on a cylindrical bearing surface of the other element. When the relative movement between the two elements is reversed, the rubbing portion of the helical spring binds on the cylindrical bearing surface., ~~this~~ The helical spring may be bound ~~binding being caused~~ by the diametral expansion of the helical spring by the unwinding effect in a cylindrical bearing surface of a housing or by the winding effect on the cylindrical bearing surface of a shaft.

~~Such f~~Freewheel devices ~~are~~ may be used ~~in particular~~ in alternator pulleys ~~in order~~ to ~~prevent~~ inhibit the transmission of ~~the~~ acyclicalities of ~~the~~ an engine to the alternator, particularly via a belt. ~~By thus b~~Being able to temporarily decouple ~~the~~ an alternator from ~~the~~ an engine, ~~it prevents, for example when there is a sudden drop in engine speed,~~ may inhibit the alternator from becoming the driver and causing a belt voltage reversal when for example there is a sudden drop in engine speed. This ~~therefore~~ may spares the transmission belt, which enables its service life to be significantly increased.

~~Reference may be made to document~~ WO A 98/50 709 entitled "SERPENTINE DRIVE SYSTEM WITH IMPROVED OVER-RUNNING ALTERNATOR DECOUPLER" and ~~or to document~~ US ~~A~~ 5,598,913 entitled "ONE-WAY OVER-RUNNING CLUTCH PULLEY" describe a drive system and a pulley system. The bearing function is performed by one or more antifriction bearings or rolling bearings and the freewheel function is performed by a helical spring one end of which is interlocked with a piece connected to an inner rotating portion and a certain number of coils of which interact with the cylindrical bore of an outer piece in order to transmit a torque or no torque between the inner and outer pieces depending on the relative direction of rotation between those two pieces.

Such devices ~~are satisfactory but~~ still have certain disadvantages. When the device is freewheeling, a ~~certain~~ number of coils of the spring rub in the outer piece with a relatively high speed equal to the differential angular speed between the two pieces, for example between the pulley and the hub. This may lead to rapid wear of the spring and undesirable failures of the device.

SUMMARY

Herein we describe a freewheel bearing device that may ~~The invention seeks to~~ increase the service life of freewheel bearings. The device may ~~The invention seeks to~~ reduce ~~the~~ wear on freewheel bearings. ~~The invention proposes~~In some embodiments, a freewheel bearing device ~~comprising~~ may include a rolling bearing and a freewheel. ~~furnished with~~ A rolling bearing may include a plurality of rolling elements and a cage. The cage may ~~to~~ retain the rolling elements., ~~and a~~ A freewheel ~~furnished with~~ may include a ~~freewheel~~ spring. ~~Said~~ A spring ~~comprises~~ may include a first ~~portion~~ end, a second end, and/or a radial central portion. A radial central portion may interact~~ing~~ with the cage. ~~and a~~ A ~~second portion~~ end of the spring may interact~~ing~~ with an element, such as an outer element and/or an inner element (e.g., an outer support, a shaft, etc.)., ~~said~~ Elements, such as an outer and/or inner element (e.g., an outer support or shaft) may be ~~being~~ directly or indirectly interlocked with a body on which the rolling elements run.

In some embodiments, ~~The~~the sliding speed ~~of sliding~~ of the spring relative to the cage or to ~~said~~ an element (e.g., an inner or outer element, such as an outer support or shaft) ~~is~~ may be limited to ~~substantially~~ approximately half the rotation speed of the bearing. ~~Consequently there is~~ Limiting the sliding speed of the spring may ~~a considerable reduction~~ reduce ~~in the~~ wear of the spring and ~~of~~ the piece ~~on which said~~ the spring ~~rubs~~ contacts when it is not transmitting torque. In a ~~relative~~ first direction of rotation, the spring ~~is~~ may slide ~~sliding~~ and the freewheel ~~is said to~~ may be disengaged. In ~~the opposite~~ second direction of rotation, the spring ~~is~~ may be engaged and the freewheel ~~is said to~~ may be engaged. A torque may ~~then~~ be transmitted between the outer and inner elements of the bearing.

For the purposes of this application, ~~By~~ directly interlocked refers to ~~it is meant that said~~ when an outer or inner element is ~~either of~~ one piece with ~~said~~ a body, or in contact with and/or ~~attached~~ coupled to ~~to said~~ the body. For the purposes of this application, ~~and~~ indirectly interlocked ~~means~~ refers to when an outer or inner ~~that said~~ element is ~~attached~~ coupled to ~~said~~ a body by ~~means of~~ one or more interposed pieces.

In one embodiment ~~of the invention~~, ~~said~~ a spring ~~comprises~~ may include an end or radial central portion ~~a portion~~ interlocked in rotation with the cage. ~~The~~ A spring may be in frictional contact with the outer and/or inner element. ~~Said~~ A spring may ~~comprise~~ include

coils that may interact ~~interacting~~ with a cylindrical bearing surface of ~~said~~ the outer or inner element.

In ~~another~~ certain embodiments ~~of the invention~~, ~~said~~ a spring ~~comprises~~ may include an end ~~portion~~ interlocked in rotation with ~~said~~ an outer or inner element (e.g., an outer support or shaft). ~~The~~ A spring may be in frictional contact with the cage. ~~Said~~ A spring may ~~comprise~~ include coils that may interact ~~interacting~~ with a cylindrical bearing surface of the cage.

In one embodiment of the invention, ~~the~~ a freewheel ~~comprises~~ includes a single spring. In ~~another~~ certain embodiments ~~of the invention~~, the freewheel ~~comprises~~ may include two springs.~~,~~ ~~F~~for example, one spring may be mounted between the cage and the outer element (e.g., outer support) and the other spring may be mounted between the cage and the inner element (e.g., shaft).

In ~~one~~ some embodiments ~~of the invention~~, the antifriction bearing ~~comprises~~ may include an outer ~~race~~ groove and an inner ~~race~~groove. ~~The r~~Rolling elements ~~are then~~ may be positioned ~~disposed~~ between ~~the~~ outer and inner ~~races~~grooves. In an embodiment, ~~A~~at least one of the ~~races~~ grooves may ~~comprise~~ include an axial extension capable of interacting with the spring. ~~The~~ An axial extension may ~~be provided with~~ include a bearing surface. In an embodiment, the bearing surface may ~~capable of~~ rub~~bing~~ against or make contact with the spring. ~~or be provided with a bearing surface to which o~~One end of ~~the~~ a spring may be coupled to the bearing surface. ~~is attached.~~ Advantageously, the cage ~~comprises~~ may include an axial extension in contact with the first portion of the spring.

A spring of a freewheel may be various shapes. In one embodiment of the invention, ~~the~~ a spring ~~is~~ may be helical. ~~In one embodiment of the invention, the~~ A spring ~~has~~ may include a rectangular section. ~~The~~ A spring may ~~thus~~ be radially compact. A spring and a body may be a single unit.

~~Said element may be made as a single unit with said body.~~

In some embodiments, ~~The invention also proposes~~ a pulley ~~comprising~~ may include a freewheel bearing device and a pulley body interlocked with an outer element of the

bearing. The freewheel bearing ~~comprises~~ may include an antifriction bearing and a freewheel with a spring. ~~furnished with a~~ An antifriction bearing may include a plurality of rolling elements and a cage, which may ~~to~~ retain the rolling elements.~~, and a freewheel furnished with a spring.~~ ~~The~~ In an embodiment, a spring ~~comprises~~ may include a first ~~portion~~ end, a second end, and/or a radial central portion. A radial central portion may interact~~ing~~ with the cage and ~~a second portion~~ a first and/or second end may interact~~ing~~ with an outer and/or an inner element (e.g., outer support and/or shaft).~~, said~~ Outer and/or inner elements ~~being~~ may be interlocked with a body on which the rolling elements run.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the methods and apparatus of the present invention will be more fully appreciated by reference to the following detailed description of presently preferred but nonetheless illustrative embodiments in accordance with the present invention when taken in conjunction with the accompanying drawings in which:

FIG.1 depicts an embodiment of a freewheel bearing;

FIG. 2 depicts a cross-sectional view of an embodiment of a freewheel bearing;

FIG. 3 depicts an embodiment of outer and inner coils of a spring;

FIG. 4 depicts an embodiment of a freewheel bearing;

FIG. 5 depicts an embodiment of a freewheel bearing in a pulley;

FIG. 6 depicts an embodiment of a freewheel bearing device with an inner spring;

FIG. 7 depicts an embodiment of a freewheel bearing device with an outer spring;

FIG. 8 depicts an embodiment of a freewheel bearing;

FIG. 9 depicts an embodiment of a freewheel bearing;

FIG. 10 depicts an embodiment of a freewheel integrated in an antifriction bearing.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DETAILED DESCRIPTION OF EMBODIMENTS

As ~~can be seen in figures~~ depicted in FIGS. 1 to 3, a freewheel bearing 1 ~~comprises~~ may include an antifriction rolling bearing 2 and a freewheel 3. A freewheel 3 may be positioned ~~mounted~~ between an inner element (e.g., a shaft) 4 with an axisymmetric cylindrical outer surface and an outer element (e.g., an outer support) 5 having a cylindrical bore 6. In an embodiment, a freewheel 3 may be mounted between a shaft 4 and an outer support 5.

The antifriction rolling bearing 2 ~~comprises~~ may include an outer ~~race~~ groove 7, an inner ~~race~~ groove 8, a row of rolling elements 9, and a cage 10. A cage may ~~to~~ retain ~~the~~ rolling elements 9. ~~The~~ An outer ~~race~~ groove 7 ~~has an~~ may include an outer surface 7a positioned ~~mounted, for example fitted, into~~ in a ~~the~~ cylindrical bore 6 of ~~the~~ an outer support 5.~~,~~ An outer groove 7 may include a rolling bearing ~~raceway~~ channel 7b formed on its bore~~,~~ and/or two opposing radial transverse surfaces 7c and 7d. The inner ~~race~~groove 8 ~~has~~ may include a bore 8a ~~mounted, for example fitted, onto~~ positioned on ~~the~~ an outer surface of ~~the~~ a shaft 4~~,~~. A bore 8a may be coupled on an outer surface of a shaft 4. An inner groove 8 may include a rolling bearing ~~raceway~~channel 8b formed on its outer surface~~,~~ and two opposing radial transverse surfaces 8c and 8d. ~~The r~~Rolling elements 9 may be ~~, here~~ balls.~~,~~ Rolling elements 9 may be positioned ~~are disposed~~ between the rolling bearing ~~raceway~~channels 7b and 8b. ~~The~~

In some embodiments, a cage 10 ~~comprises~~ may include receptacles evenly distributed in the circumferential direction in which the rolling elements 9 are ~~mounted~~positioned.~~,~~ A cage 10 may include portions 11 between the receptacles and a continuous circular portion 12 on one side of the rolling elements 9 radially between the ~~race~~grooves 7 and 8. ~~The~~ A cage 10 ~~is made of~~ may be made of molded synthetic material, ~~for example of~~ such as, but not limited to, polyamide reinforced with glass fiber.

In an embodiment, a ~~The~~ cage 10 ~~also comprises~~ may include an axial extension 13 which extend~~sing~~ beyond the radial plane as defined by the radial transverse surfaces 7c and 8c of the ~~race~~grooves 7 and 8. ~~The~~ An axial extension 13 ~~is of~~ may be generally circular~~,~~ ~~shape and has~~ An axial extension 13 may include a cylindrical outer surface 13a ~~of~~ with a greater diameter than ~~that of~~ a diameter of a ~~the~~ bore of the outer ~~race~~groove 7.~~, and~~ An axial

extension 13 may include a cylindrical bore 13b with a smaller~~of lesser~~ diameter than ~~that of~~ the diameter of ~~the~~ an outer surface of the inner ~~race~~groove 8. An~~The~~ axial length of ~~the~~ an axial extension 13 may be similar to the axial length ~~is close to that~~ of ~~the~~ a rolling bearing 2. In an embodiment, a ~~The~~ cage 10 may be ~~is a made as~~ a single unit.

In some embodiments, ~~In addition to the axial extension 13 of the cage 10, the~~ a freewheel 3 ~~comprises~~ may include a spring 14 of a substantially helical ~~general~~ shape. ~~The~~ A spring 14 ~~comprises~~ may include ~~one~~ a first end 15 formed of several coils. A spring 14 may include a first end 15 formed of three coils. ~~, here three,~~In an embodiment, a first end 15 of a spring may ~~in~~ contact ~~with the~~ a cylindrical bore 6 of the outer support 5.~~,~~ A second ~~another~~ end 16 of a spring may include ~~formed of~~ several coils. A second end 16 of a spring may include 3 coils. ~~, here three,~~A second end 16 of a spring may ~~in~~ contact ~~with the~~ an outer surface of the shaft 4.~~, and~~ A spring may include a radial central portion 17. A radial center portion may pass~~ing~~ through a radial notch formed ~~in the extension 13~~ or sunk into ~~the~~ an axial extension 13, for example by overmolding. ~~The~~ A radial central portion 17 of ~~the~~ a spring 14 ~~is thus~~ may be interlocked in rotation with ~~the~~ an extension 13 and ~~the~~ a cage 10.

~~The~~ In some embodiments, a freewheel bearing device may operates by the take-up of torque~~,~~ when the relative movement of the outer support 5 relative to the shaft 4 occurs in the direction of the arrow indicated in figure 2, ~~for example~~ such as when the shaft 4 is immobile and when the outer support 5 is driven in the direction of the arrow. ~~Specifically, the~~ A cage 10 of the rolling bearing may rotate~~ing~~ at an angular speed equal to approximately half the difference of the angular speeds of the outer ~~race~~ 7 and inner ~~race~~grooves 8.~~,~~ ~~if~~If ~~the~~ an outer ~~race~~groove 7 of the rolling bearing ~~has a relative movement~~ moves relative to the inner ~~race~~groove 8 in the direction of the arrow, the cage 10 may rotate~~ing~~ more slowly than the outer ~~race~~groove 7, and the result is that the outer coils of the spring 14 which are coupled ~~is connected~~ to the cage 10 by its radial portion 17, may have a tendency, by friction on the cylindrical bore 6 of the outer support 5, to tighten ~~in the latter~~. Simultaneously, the ~~inner~~ second end 16 of the spring 14, driven by the cage 10 may rolls up and tightens on the shaft 4. The spring 14 may thus transmits ~~the~~ torque between the outer support 5 and the shaft 4.

In some embodiments, if~~If~~ ~~the~~ a radial load on the rolling elements 9 is sufficient and the torque to be transmitted is relatively weak, the torque may be transmitted between the ~~outer~~ first end 15 of the spring 14 and the shaft 4 via the cage 10 and the rolling element 9

before the inner coils of the end 16 are retightened on the shaft 4. ~~In this case, t~~The inner coils of the end 16 ~~will~~ may intervene to transmit the torque if the ~~latter~~ torque increases above a certain value and causes the rolling elements 9 to slide in their rolling bearing ~~raceway~~channel 8b. ~~Naturally,~~ In an embodiment a ~~the~~ stiffness of the spring 14 ~~can be chosen~~ may be selected such that the torque is not transmitted by the rolling elements 9.

If the direction of ~~the~~ relative movement is reversed between the outer support 5 and the shaft 4, the inner coils of the second end 16 of the spring 14 may loosen and ~~, thereby~~ allow~~ing~~ a relative angular movement with friction between the spring 14 and the shaft 4. The outer coils of the first end 15 of the spring 14 may also loosen~~, thereby~~ and allow~~ing~~ a relative angular movement with friction between the spring 14 and the cylindrical bore 6 of the outer support 5. The device then may operates in freewheel mode.

Numerous variations ~~variants~~ and applications of the device may be ~~envisaged~~envisioned. ~~Figure~~FIG. 4 ~~shows a variant in which the reference numbers of similar elements are retained~~depicts an embodiment of a freewheel bearing. The freewheel 3 ~~comprises~~ may include two independent springs, ~~one~~ an inner spring 19 and ~~another~~ an outer spring 20. ~~The~~ An inner spring 19 ~~is disposed~~ may be positioned between the bore 13b of ~~the~~ an axial extension 13 of the cage 10 and ~~the~~ an outer cylindrical surface of the shaft 4. An inner spring 19 may include ~~with~~ a plurality of coils. In an embodiment an inner spring 19 may include three coils.~~, here three,~~ Coils of an inner spring 19 may ~~in~~ contact ~~with the~~ a bore of the axial extension 13. ~~and one~~An end 21 of the inner spring 19 may be angularly interlocked with the shaft 4. ~~The~~ An outer spring 20 ~~comprises~~ may include a plurality of coils. In an embodiment, an outer spring 20 may include three coils. ~~, here three,~~ Coils of an outer spring 20 may ~~in~~ contact ~~with the~~ an outer cylindrical surface 13a of ~~the~~ an axial extension 13 of the cage 10. ~~and one~~ An end 22 of an outer spring 20 may be angularly ~~attached~~ coupled to ~~in the~~ a bore 6 of the outer support 5.~~, for~~ For example, an end 22 of an outer spring 20 may be coupled to a bore 6 by ~~means of~~ a notch 23 formed in ~~said~~ the bore 6 and into which ~~the~~ an end 22 of the spring 20 protrudes.

In ~~one~~ a first relative direction of rotation between the outer support 5 and the shaft 4, the coils of the springs 19 and 20 ~~rub~~ may contact ~~on the~~an axial extension 13 of the cage 10 and ~~thus~~ may allow ~~a~~ rotation without a transmission of significant torque. In ~~the other~~ a second relative direction of rotation, the springs 19 and 20 may tighten on ~~the~~ an axial

extension 13 of the cage 10 and may transmit a torque while ~~making~~ angularly interlocking in one direction ~~the~~ an outer support 5 ~~angularly interlocked in one direction~~ with the shaft 4.

~~In the embodiment illustrated in~~As depicted in FIG. ~~figure~~ 5, the freewheel bearing device 1 ~~is mounted~~ may be coupled to ~~in~~ a pulley. The outer support 5 may ~~which then~~ forms the pulley body. The outer support 5 may include ~~has~~ an outer surface 24 in the form of trapezoidal crenellations adapted to a pulley of the poly-V type. ~~The~~ A cylindrical bore 6 ~~is~~ may be limited by a shoulder 25 formed at one axial end of the outer support 5 and in contact with the transverse surface 7d of the outer ~~race~~groove 7. The shaft ~~is~~ may be replaced by a hub 26 ~~also having~~ with a shoulder 27 which may delimit~~ing~~ its outer cylindrical surface and allow~~ing an~~ axial positioning of the inner ~~race~~groove 8 of the antifriction bearing 2. The hub 26 ~~has~~ may include a bore 28.

~~The embodiment illustrated in figure~~FIG. 6 depicts an embodiment of a freewheel bearing device ~~is provided~~ for applications in which the torque to be transmitted is relatively weak. ~~This embodiment is comparable to that in figure 4 except that it has~~ A freewheel bearing device may not include an ~~no~~ outer spring. ~~The~~ A bore 6 of the outer support 5 ~~also~~ may not include ~~has no~~ a notch. ~~The~~ In an embodiment, a freewheel 3 ~~comprises~~ for applications with low torque transmission may include a single spring~~, that is~~. A spring may include an ~~the~~ inner spring 19 whose free end 21 is interlocked in rotation with the shaft 4~~, and whose c~~Coils of an inner spring 19 may contact or rub ~~on the~~ a bore 13b of ~~the~~ an axial extension 13 of the cage 10. In locking mode, ~~the~~ coils in radial extension ~~are~~ may be locked in the bore 13b of ~~the~~ a radial extension 13 and therefore interlock ~~the~~ a cage 10 with ~~the~~ a shaft 4. The rolling elements 9 ~~are therefore~~ may also be interlocked with the shaft 4~~, and the~~. An outer ~~race~~groove 7 may be interlocked with the outer support 5 and may ~~remains~~ substantially stationary relative to the shaft 4, as long as ~~insofar as~~ the torque to be transmitted is not too great and the radial load of the antifriction bearing 2 is sufficient. This ~~is~~ may be a particularly economical embodiment.

~~The embodiment in figure~~FIG. 7 depicts a freewheel bearing device with a ~~is also economical with~~ a single ~~spring, that is the~~ outer spring 20. A freewheel bearing device with a single outer spring may be economical. ~~As for the rest, this embodiment is similar to that of figure 4. As for the embodiment in figure 6, it is an economical variant fitted with a~~A single

outer spring 20 ~~here placed~~ may be positioned between ~~the~~ a radial extension 13 of the cage 10 and the outer support 5.

~~The embodiment in figure~~ FIG. 8 depicts an embodiment of a freewheel bearing ~~is~~ similar to the embodiment in ~~figure~~ FIG. 1 except that the spring ~~has~~may not include ~~no~~ a ~~outer portion~~second end with coils. ~~The s~~Spring ~~bearing reference number~~ 29 ~~comprises~~ may include an ~~inner part~~ first end 15 similar to ~~that~~ the embodiment of the spring depicted in figure 1 and may include a radial portion 17 ~~facing~~ that faces outward and may interfere ~~interfering~~ with ~~the~~ an axial extension 13 of the cage 10. ~~More precisely, said~~ In an embodiment, an axial extension 13 ~~is provided~~ may include ~~with~~ a notch 18 extending radially outward from its bore over a portion of its radial height and disposed at its free axial end opposite the rolling elements 9. ~~The~~ A radial portion 17 of ~~the~~ a spring 29 may protrudes into ~~said~~ the notch 18 and interlocks in rotation. ~~the~~ A radial portion 17 may form ~~forming~~ one end of the spring 29 with the cage 10.

In an embodiment, an economical embodiment of a freewheel bearing device may include ~~This embodiment is therefore also economical with~~ a single spring ~~placed~~ positioned on a single side of the cage, such as ~~here on~~ the inside surface of the cage. In torque transmission mode, ~~the~~ a ~~inner portion~~ first end 15 of ~~the~~ a spring 29 ~~is~~ may engaged with ~~the~~ a shaft 4. ~~whereas in~~ In a disengaged mode, ~~the~~ coils of ~~the~~ the first end ~~inner portion~~ 15 ~~are in~~ may contact ~~with the~~ a shaft 4 with ~~a~~ slight friction. ~~The~~ A cage 10 may then turns freely relative to the shaft 4.

FIG 9 depicts an embodiment of a freewheel bearing similar to ~~The embodiment illustrated in figure 9 is similar to that in figure~~ FIG. 1. ~~The~~ A freewheel ~~comprises~~ may include a single spring 30 ~~placed~~ positioned between ~~the~~ an axial extension 13 of the cage 10 and the outer support 5. ~~The~~ A spring 30 ~~comprises~~ may include coils which form~~ing~~ an ~~outer portion~~ second end 16 similar to ~~that illustrated~~ the embodiment depicted in ~~figure~~ FIG. 1. ~~and~~ A spring may include a radial portion 17 protruding into a notch 18 which extends~~ing~~ radially inward from the outer cylindrical surface 13a of the axial extension 13 of the cage 10. ~~and~~ A radial portion may be formed at ~~the~~ a free axial end of ~~the~~ an axial extension 13 and opposite the rolling elements 9. The radial portion 17 ~~placed~~ positioned in the notch 18 ~~is~~ may interlocked in rotation with the cage 10 while the coils forming the ~~outer portion~~ second end 16 ~~are~~ may tightened in the cylindrical bore 6 of the outer support 5 and thus may

~~providing~~ provide a transmission of torque, or, in the case of reversal of relative rotation, may rotate at the same angular speed as the cage 10 with a slight friction relative to said bore 6 of the outer support 5.

In the embodiment illustrated in ~~figure~~ FIG. 10, ~~the~~ a freewheel 3 ~~is~~ may be integrated ~~into~~ in the antifriction bearing 2. ~~More precisely~~For example, ~~the~~ an outer ~~race~~groove 7 ~~comprises~~ may include an axial extension 31 on the side of the freewheel 3 ~~which~~ that includes ~~has~~ radial dimensions ~~identical~~ substantially similar to the rest of the outer ~~race~~groove 7. ~~Likewise, the~~ The inner ~~race~~groove 8 ~~comprises~~ may include an axial prolongation 32, which has ~~the same~~ a similar bore as the inner ~~race~~groove 8, and an outer cylindrical surface of ~~lesser~~ a smaller diameter., ~~for~~ For example, a diameter of an outer cylindrical surface may substantially equal ~~to that of~~ the diameter of the bottom of the antifriction bearing ~~raceway~~channel 8b. ~~The~~ A cage 10 ~~comprises~~ may include an axial extension 33 with ~~the same~~ similar inner and/or outer diameters as the circular portion 12 and as the portions 11 formed between the receptacles in which the rolling elements 9 are ~~disposed~~positioned.

A spring 29, similar ~~to that mounted in~~ the embodiment illustrated in ~~figure~~ FIG. 8 but ~~of~~ with smaller dimensions, may include ~~comprises an inner portion~~ a first end 15, ~~provided~~ with a plurality of coils in contact with the outer cylindrical surface of ~~the~~ an axial prolongation 32 of the inner ~~race~~groove 8, and a radial portion 17, which may protrude ~~protruding~~ into ~~the~~ an axial extension 33 of the cage 10., In an embodiment, a radial portion 17 may ~~more precisely protruding~~ protrude into a radial blind hole, which is not shown., A radial blind hole may be formed from the bore of the axial extension 33 and facing outward, or sunk into the material forming the axial extension 33. Thus, ~~the~~ a spring 29 may include ~~has one~~ a first end, ~~that is~~ the radial portion 17, interlocked in rotation with the cage 10 and ~~another~~ a second end formed by the coils of the ~~inner portion~~ first end 15. ~~and which is capable of being either~~ A second end 16 may be interlocked in rotation with the inner ~~race~~groove 8 in torque transmission mode., ~~or of~~ A second end may move~~ing~~ with a slight friction relative to ~~said~~ the outer surface of the axial prolongation 32 of the inner ~~race~~groove 8 in freewheel mode, in which the outer ~~race~~groove 7 and the inner ~~race~~groove 8 move at different angular speeds. This embodiment ~~is~~ may be extremely compact and/or may combines the functions of rolling bearing and freewheel.

In some embodiments, ~~Generally, it is also conceivable to furnish~~an embodiment of the device illustrated in ~~figure~~ FIG. 1 may include ~~with~~ two springs such as the springs 28 and 29 of the embodiments in ~~figures~~ FIGS. 8 and 9, rather than ~~thus replacing the~~ spring 14. The embodiment of the device illustrated in ~~figure~~ FIG. 10 ~~could perfectly well~~ may be equipped with springs ~~of the types~~ similar to the springs illustrated in the other embodiments, such as ~~notably the~~ spring 14 depicted in ~~figure~~ FIG. 1 or ~~be furnished with two~~ springs 29, ~~and~~ 30 depicted in FIGS. 8 and 9.

~~Generally, d~~During freewheel operation, ~~the~~ friction between ~~the~~ coils of ~~the~~ a spring and the corresponding friction bearing surface ~~is~~ may be generated at a reduced relative speed arising directly from the differential angular speed between ~~the~~ a cage of ~~the~~ an antifriction bearing and ~~the~~ a ~~race~~groove of the antifriction bearing to which the friction bearing surface is ~~connected~~coupled. Wear of the spring by friction ~~is therefore~~ may be substantially ~~considerably~~ reduced since the antifriction bearing cage may rotates at an angular speed equal to approximately half the difference between~~of~~ the angular speeds of the ~~race~~grooves. If N is the differential angular speed between ~~the~~ an outer ~~race~~groove and ~~the~~ an inner ~~race~~groove of ~~the~~ an antifriction bearing in freewheel operation, the differential angular speed between the spring and its friction bearing surface ~~will~~ may ~~be~~ substantially equal ~~to~~ N/2 according, ~~to the invention~~ in an embodiment, instead of N ~~in the case of the~~ such as in the prior art. ~~Evidently the~~ A result ~~is~~ may be an appreciable increase in the lifetime of the system ~~according to the invention~~.

In this patent, certain U.S. patents, U.S. patent applications, and other materials (e.g., articles) have been incorporated by reference. The text of such U.S. patents, U.S. patent applications, and other materials is, however, only incorporated by reference to the extent that no conflict exists between such text and the other statements and drawings set forth herein. In the event of such conflict, then any such conflicting text in such incorporated by reference U.S. patents, U.S. patent applications, and other materials is specifically not incorporated by reference in this patent.

Further modifications and alternative embodiments of various aspects of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the general manner of carrying out the invention. It is to be understood that

the forms of the invention shown and described herein are to be taken as the presently preferred embodiments. Elements and materials may be substituted for those illustrated and described herein, parts and processes may be reversed, and certain features of the invention may be utilized independently, all as would be apparent to one skilled in the art after having the benefit of this description of the invention. Changes may be made in the elements described herein without departing from the spirit and scope of the invention as described in the following claims.

ABSTRACT

~~The inventive device of a~~A free wheeling bearing ~~(1) comprises~~ may include a rolling bearing and a freewheel. A rolling bearing may include ~~(2) provided with~~ a plurality of rolling elements ~~(9),~~and a cage ~~(10)~~ which may ~~for~~ retaining ~~said~~ the rolling elements. ~~(9) and a~~ A free wheel ~~(3) provided with~~ may include a spring ~~(14)~~. ~~Said~~ A spring ~~(14) comprises~~ may include a first end, a second end, and a radial central portion. ~~a first part (17)~~ A radial central portion may interact~~ing~~ with ~~the~~ a cage. ~~(10) and a~~ Ends of the spring ~~second part (15) therof~~ may interact~~ing~~ with an ~~external~~ outer or an ~~internal~~ inner element (e.g., an outer support or a shaft). ~~which is~~ Elements may be directly or indirectly ~~connected~~ coupled to a body on which the rolling elements run.